

REMARKS

Claims 1, 12-31,33-38,40-46,55-59,64,69-72,77-81, 84-86,91-96, 103 and 109-129 are in the application. Changes have been made to claims 1, 12, 24 , 34, 36, 38, 39, 40, 42, 46, 48, 55, 57, 58, 59, 64, 69, 77, 84 and 86. Claim 109 - 129 are added.

A form 1449 listing all the art cited in the related parent application will be submitted shortly hereafter in a subsequent paper.

Claim Rejections - 35 USC § 112

The specification has been objected to under 35 U.S.C. § 112, first paragraph, as failing to provide an enabling disclosure commensurate with the scope of the claims.

Applicants respectfully disagree for the reasons given below.

The Examiner states that "[t]he present specification is deemed to be enabled only for apparatuses with compositions comprising at least one each of rare earth (or IIIB), an alkaline earth, and copper oxide." Applicants respectfully disagree.

The Examiner further states that "[t]he art of high temperature (above 30°K) superconductors is an extremely unpredictable one. Small changes in composition can result in dramatic changes in or loss of superconducting properties." Applicants' claims are not directed to a composition of matter. Applicatnts' claims are directed to an apparatus , structure, device or invention having a superconducting current flowing therein or carrying a superconducting current. The superconducting component is a transition metal oxide. Applicants discovered that transition metal oxides have superconducting onset or transition temperatures greater than 26°K. Applicants have enabled what they have discovered and claimed. The Examiner's statement that "[s]mall changes in composition can result in dramatic changes in or loss of superconducting properties." has not been supported by any evidence not contained within applicants' teaching. Any teaching by applicants about the amounts of constituent and processing steeps is part of applicants' enabling discolosure.

The Examiner further states that "[t]he amount and type of examples necessary to support broad claims increases as the predictability of the art decreases." Once applicants discovered that transition metal oxides were superconducting at temperatures greater than 26°K., it was within the skill of the art to apply applicants teaching to use other specific examples of transition metal oxide compounds for superconducting apparatus, devices structures and inventions. The Examiner has not shown by evidence not contained within applicants teaching that the art of high T_c superconductors is unpridictable in view of applicants' teaching.

The Examiner further states that "[c]laims broad enough to cover a large number of compositions that do not exhibit the desired properties fail to satisfy the requirements of 35 USC 112." The Examiner has not shown that the claims are broad enough to cover a large number of compositions that fail. Again the Examiner is applying an incorrect standard. The Examiner is applying a standard applicable to composition of matter. Applicants are not claiming a composition of matter. As shown below applicants have in fact fully enabled the composition of matter. Therefore, applicants have provided excess enablement for the claimed invention. The standard of enablement for an apparatus or device is not the same as the standard of enablement for a composition of matter. Notwithstanding, it is well settled law that claims to a composition of matter can encompass a number of inoperable species. Applicants' claims do not cover inoperable species. The claims only encompass apparatus, structures, devices and inventions that include transition metal oxides that are superconducting at temperatures in excess of 26°K and that show a zero resistance onset at temperatures in excess of 30°K. Those transition metal oxides that are not superconducting at temperatures in excess of 26°K and that show a zero resistance onset at temperatures in excess of 30°K are not encompassed by applicants claims reciting these limitations. Applicants note that a claim to a composition of matter is dominant to any use of that composition of matter and claims directed to a use of a composition of matter are necessarily of narrower scope than claims to the composition of matter. Applicants' claims do not encompass uses other than those to which the claims are limited to by the use limitations recited in the claims. Applicants' claims are directed to what they have discovered. Therefore, applicants' claims fully satisfy the requirements of 35 USC 112.

The Examiner further states that "[m]erely reciting a desired result does not overcome this failure." Applicants' claims do not "merely recite a desired result". Some claims recite a means for passing a superconducting current through the material. Other claims recite "a superconducting current flowing" or "carrying a superconducting current". This is not "a desired result", but an actual structural element or an actual action occurring. If an apparatus, structure, device or invention is made with material that is not superconducting at temperatures in excess of 26°K, such apparatus, structure, device or invention will not be encompassed by the claims reciting this limitation. Again applicants' claims are not directed to a chemical composition.

The Examiner further states "[i]n particular, the question arises: Will any layered perovskite material containing copper exhibit superconductivity?" The claims do not cover "any layered perovskite". The claims do not cover a material. The claims cover an apparatus, structure, device or invention using a material. Only those apparatuses, structures, devices or inventions using the recited elements of the claims are covered by the claims. The Examiner is again applying an incorrect standard, a standard applicable to a chemical composition which is dominant to all uses of the chemical composition. Applicants' note, however, that they have fully enabled the compositions.

The Examiner further states "[i]t should be noted that at the time the invention was made, the theoretical mechanism of superconductivity in these materials was not well understood. That mechanism still is not understood." Whether or not this statement is true or not true is of no relevance to applicants claims which are directed to apparatus, structures, devices and inventions using the compositions. The mechanism does not have to be understood to use the material as claimed by applicants. Applicants have discovered that transition metal oxides are useful for apparatus, structures, devices and inventions that have elements that are superconducting at temperatures in excess of 26°K. The Examiners comments, if applicable, are applicable to claims directed to specific chemical compounds but not to applicants claims. Nor would they be applicable to generic composition claims.

The Examiner further states "[a]ccordingly, there appears to be little factual or theoretical basis for extending the scope of the claims much beyond the proportions and materials actually demonstrated to exhibit high temperature superconductivity." Again this comment is not applicable to claims directed to apparatus, structures , devices and inventions as claimed. Applicants have discovered that transition metal oxides are superconducting at temperatures in excess of 26°K are useful for apparatus, structures, devices and inventions as claimed.

The Examiner further states "[a] 'patent is not a hunting license. It is not a reward for the search, but a reward for its successful conclusion' ". Applicants are not claiming specific compounds that they have not described. Applicants are generically and specifically claiming what they have discovered. Thus applicants are not "hunting" for anything. Applicants successful conclusion is their discovery that transition metal oxides are superconducting at temperatures in excess of 26°K and can thus be used for apparatus, structures , devices and inventions as claimed.

In the discussion herein applicants will frequently refer to the book "Copper Oxide Superconductors" by Charles P. Poole, Jr., Timir Datta and Horacio A. Farach, John Wiley & Sons (1988). This book shall be referred to herein as Poole et al.. The preface of this book says "[t]his volume reviews the experimental aspects of the field of oxide superconductivity with transition temperatures from 30 K to above 123 K, from the time of its discovery by Bednorz and Muller in April 1986 until a few months after the award of the Nobel Prize to them in October, 1987." This passage is referring to applicants and their paper referred to at page 6 of applicants' specification. This book acknowledges that applicants are the discoverers of the field of high temperature superconductivity. (See Attachment H)

Applicants note that it is generally recognized that it is not difficult to fabricate transition metal oxides and in particular copper metal oxides that are superconductive after the discovery by applicants that transition metal oxides are high T_c .

superconductors. Chapter 5 of the Poole et al. book entitled Preparation and Characterization of Samples" states at page 59 "[c]opper oxide superconductors with a purity sufficient to exhibit zero resistivity or to demonstrate levitation (Early) are not difficult to synthesize. We believe that this is at least partially responsible for the explosive worldwide growth in these materials. " Poole et al. further states at page 61 "[i]n this section three methods of preparation will be described, namely, the solid state, the coprecipitation , and the sol-gel techniques (Hatfi). The widely used solid-state technique permits off-the-shelf chemicals to be directly calcined into superconductors, and it requires little familiarity with the subtle physicochemical process involved in the transformation of a mixture of compounds into a superconductor." Poole et al. further states at pages 61-62 "[i]n the solid state reaction technique one starts with oxygen-rich compounds of the desired components such as oxides, nitrates or carbonates of Ba, Bi, La Sr, Tl, Y, or other elements. ... These compounds are mixed in the desired atomic ratios and ground to a fine powder to facilitate the calcination process. Then these room-temperature-stable salts are reacted by calcination for an extended period (~20 hr) at elevated temperatures (~900°C). This process may be repeated several times, with pulverizing and mixing of the partially calcined material at each step." This is generally the same as the specific examples provided by applicants and as generally described at pages 8, line 19, to page 9, line 5, of applicants' specification which states "The methods by which these superconductive compositions can be made can use known principles of ceramic fabrication, including the mixing of powders containing the rare earth or rare earth-like, alkaline earth, and transition metal elements, coprecipitation of these materials, and heating steps in oxygen or air. A particularly suitable superconducting material in accordance with this invention is one containing copper as the transition metal." (See Attachment H)

Consequently, applicants have fully enabled high T_c transition metal oxides and their claims.

Claims 1, 12-31, 33-38, 40-46, 55-59, 64, 69-72, 84, 85, and 91-96 have been rejected under 35 U. S. C. § 1 12, first paragraph, for the reasons set forth in the objection to the specification. Applicants respectfully disagree for the reasons given above in response to the objection to the specification.

Claims 1, 12-31, 33-38, 40-46, 55-59, 64, 69-72, 77-81, 84-86, 91-96, and 103 have been rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The Examiner states that " Claim 1, lines 2 and 3, is unclear with the term 'rare earth-like element'. The terms 'type' and 'like' are unclear." Applicants respectfully disagree. Attachment A is the results of a Lexis search done by the undersigned

attorney. This search shows the term "rare earth like" or "rare earth and the like" used in 68 US patents. The sections of the 68 patents where these terms appears are printed using the "KWICK" function of Lexis. Attachment B is the results of a Lexis search done by the undersigned attorney. This search shows the term "rare earth like" used in the claims of 4 issued US patents. The sections of the claims of the 4 patents where this term appears in the claims are printed using the "KWICK" function of Lexis. Consequently, the term "rare earth like" is a term use in the art, understood by a person of skill in the art and recognized as a definite term by the USPTO for use in US patent claims.

In Claim 1, line 5, the term ".us on;" has been deleted.

In Claim 1, line 7, term "supercurrent" has been changed to "superconducting current".

Claim 12, has been amended to include "and less than said transition temperature".

Claim 17 is not unclear by using the term "rare earth-like element" as described above for claim 1.

The Examiner states that "Claim 19 is unclear with the term "perovskite-like superconducting phase". The term "perovskite-like" or "perovskite-type" is commonly used in the art. Attachment C is the results of a Lexis search done by the undersigned attorney. This search shows that the terms "perovskite like" and "supercond!" (the "!" represents any combination of letters) are used in 107 US patents. The sections of the 107 patents where these terms appears are printed using the "KWICK" function of Lexis. Attachment D is the results of a Lexis search done by the undersigned attorney. This search shows the terms "perovskite like" or "perovskite type" used in the claims of two issued US patents. The sections of the claims of the 2 patents where this term appears in the claims are printed using the "KWICK" function of Lexis. Attachment E is a copy of the first page of Chapter 2 of the book "Perovskites and High T_c Superconductors" by F. S. Galasso, Gordon and Breach Scientific Publishers, 1990. Chapter 2 is entitled "Structure of Perovskite-type Compounds". Attachment F is a copy of page 78 of the book by C. Poole, Jr. et al.. Page 78 is the beginning of the section entitled "D. Perovskite-type Superconducting Structures". The first paragraph of the section states "[i]n their first report on high-temperature superconductors Bednorz and Muller (*the applicants*) referred to their samples as 'metallic, oxygen deficient ... perovskite like mixed valent copper compounds.' Subsequent work has confirmed that the new superconductors do indeed have these characteristics. In this section we will comment on their perovskite-like aspects" (inset added). Consequently, the terms "perovskite like" or "perovskite type" are terms used in the art and recognized as a definite by the USPTO for use in US patent claims. (It is noted that this passage also shows that the terminology "mixed valent copper compounds" is used and understood in the art.

The Examiner further states that "Claims 20-23 are unclear with the term 'substituted transition metal oxide'. That terminology is unclear as to what is the substitute for Cu-oxide and as to how much substitution occurs." This is a commonly used term in the art. This term is used throughout applicants specification, in particular, for example, in the sentence bridging pages 11 and 12 of applicants specification states "[i]n these compounds the RE portion can be partially substituted by one or more members of the alkaline earth group of elements." Applicants specification further teaches at page 12, lines 5 to page 12 line 1:

" For example, one such compound that meets this general description is lanthanum copper oxide La₂Clio₄in which the lanthanum - which belongs to the IIIB group of elements - is in part substituted by one member of the neighboring IIA group of elements, viz. by one of the alkaline earth metals (or by a combination of the members of the IIA group), e.g., by barium. Also, the oxygen content of the compound can be incomplete such that the compound will have the general composition La_{2-x}BaxClio_{4-y}, wherein x < 0.3 and y < 0.5.

Another example of a compound meeting this general formula is lanthanum nickel oxide wherein the lanthanum is partially substituted by strontium, yielding the general formula La_{2-x}Sr_xNiO_{4-y}. Still another example is cerium nickel oxide wherein the cerium is partially substituted by calcium, resulting in Ce_{2-x}Ca_xNiO_{4-y}.

The following description will mainly refer to barium as a partial replacement for lanthanum in a La CuO as a partial replacement for lanthanum in a La₂Clio₄ compound because it is in the Ba-La-Cu-O system that many laboratory tests have been conducted."

Moreover the book "Copper Oxide Superconductors" by Poole et al., cited above , has at page 122 a section entitled "Substitutions" (See Attachment G) which states "[a]n important question that arises concerns which of the constituent atoms are essential and which can be replaced by related or perhaps not so related atoms" Sections 1 and 2 deal with rare earth substitutions; Section 3 with alkaline earth substitutions; Section 4 with paramagnetic substitutions; Section 5 with nonmagnetic substitutions; and, Section 6 with substitutions for oxygen . Thus "substituted transition metal oxide" has been extensively described by applicants and is well understood in the art.

The Examiner further states that " Claim 24, line 6, is unclear with the term "supercurrent". It is suggested that the same term be changed to -- current --." Applicants have changed this to "current"

The Examiner further states "Claim 27, line 2, has the terminology 'substituted Cu-oxide' but that terminology is unclear as to what is the substitute for Cu-oxide and

as to how much substitution occurs." This is not unclear for the same reason as given above.

The Examiner further states :

"Claim 27, lines 2-4, has the language 'said composition being a substituted Cu-oxide including a superconducting phase having a structure substantially close to the orthorhombic-tetragonal phase transition of said composition'. That language is found to be indefinite because it is unclear how close is 'substantially close'. Relative terminology in a claim is indefinite when one of ordinary skill in the art would not be apprised of the scope of the claim.' In this case, one skilled in the art would not be able to determine whether the superconducting phase is physically close to the orthorhombic-tetragonal phase transition or whether that phase is 'like' that transition."

Applicants respectfully disagree. The language "orthorhombic-tetragonal phase transition" is generally used in the art and in particular is used by applicants in the sentence bridging pages 25 and 26 which states "[t]he highest Tc for each of the dopant ions investigated occurred for those concentrations where, at room temperature, the $RE_{2-x}TM_xO_{4-y}$ structure is close to the orthorhombic-tetragonal structural phase transition, which may be related to the substantial electron-phonon interaction enhanced by the substitution."

The Poole et al. in Chapter VI on "Crystallographic Structures" state states page 73 "[m]uch has been said about the oxide superconductor compounds being **perovskite types**, so we will begin with a description of the perovskite structure." (emphasis added) Poole further states at page 74 in Section 4 entitled "Tetragonal Form" that "[a]t room temperature barium titanate is tetragonal ... which is close to cubic." Poole further states at page 74 in Section 3 entitled "Orthorhombic Form" that "[w]hen barium titanate is cooled below 5°C it undergoes a transition with a further lowering of the symmetry to the orthorhombic space group." It is thus clear that the orthorhombic-tetragonal structural phase transition is understood by a person of skill in the art. (See Attachment I.)

The Examiner further states that "Claim 28 is unclear with the language 'rare earth-like'". Applicants respectfully disagree for the reasons given above.

The Examiner further states that "Claim 29 is unclear with the language 'substituted Cu-oxide'". Applicants respectfully disagree for the reasons given above.

The Examiner further states that "Claim 30 is indefinite with the limitation that 'said alkaline earth element is atomically large with respect to Cu'". That limitation is unclear as to how the alkaline earth element is 'large', i.e., whether size is measured according to covalent radius, metallic radius, or atomic volume. The term 'large' also is unclear as to how large is 'large'." This terminology is understood by a person of skill in the art.

At page 78 of the book by Poole et al. there is a section entitled "Atomic Sizes". Pages 79-80 of Poole et al. has a table of ionic radii of selected elements. At page 78 Poole et al. states "Table VI-2 gives the ionic radii of the positively charged ions of various elements of the periodic table. These radii are useful for estimating changes in lattice constant when ionic substitutions are made in existing structures". (See Attachment I).

It is clear therefore, that atomically large means that the alkaline earth is larger than Cu. Copper has two ionic forms each with a different radius. The alkaline earths also have several ionic form and different radii.

The Examiner further states "Claim 33, lines 3 and 4, is unclear as to whether the alkaline earth element is concentrated 'near' to the copper oxide concentration or whether the degree of alkaline earth element concentration is 'near' to the amount of copper oxide concentration. If the latter is the case, then it is unclear if the degree of concentration is in molar or weight percentages."

Applicants respectfully submit that the claim is clearly worded. The claim recites copper oxide doped with alkaline earth - the concentration of the alkaline earth has a value near to that concentration which results in an orthorhombic to tetragonal phase transition. This is what the language of the claim says.

The Examiner further states "Claim 33, lines 4-6, is unclear as to the 'superconducting copper oxide phase' changes into the tetragonal structural phase or whether that 'superconducting copper oxide phase' is found in a composition at the boundary between orthorhombic and tetragonal phases." Applicant submit that the language of the claim is clear. Applicants do not understand the Examiners comments. There is no boundary referred to in applicants claim. The Poole et al. book in Chapter 6 entitled "Crystallographic Structures" in Section B thereof entitled "Perovskites" describes various crystal structures: cubic form, tetragonal form, orthorhombic form, alternate tetragonal form. In subsection 4 on page 85 entitled Phase Transitions states "[t]he compounds $(La_{1-x} M_x)CuO_4$ with $M=Sr$ and Br are orthorhombic at low temperatures and low M content, and tetragonal otherwise." (See Attachment I) Sr and Br are alkaline earth elements. (See the definition of alkaline-earth metals from Hawley's Condensed Chemical Dictionary p 36 in Attachment J)

The Examiner further states "Claim 34 is incomplete because it involves '(a) superconducting apparatus' but comprises only a composition. Means are not provided for cooling the composition and for passing an electrical current through it." This claim has been amended to recite a means for passing a current.

The Examiner further states "Claim 34, lines 3 and 4, is indefinite with the language 'a mixed copper oxide doped with an element chosen to create Cu^{3+} ions. ... That

language is unclear because it is not possible to 'create' copper through the choice of dopants." In this claim "create" has been changed to "to result in".

The Examiner further states "Claim 36, line 4, is unclear with the language 'substituted copper oxide' ". As explained above "substituted transition metal oxide" or "substitutes copper oxide " is a term used in the art and thus is understood by a person of skill in the art .

The Examiner further states "Claim 36, lines 7-12, provides the means for passing an electrical current and cooling the composition 'while said composition is at a temperature in excess of 26°K'.

However, superconductivity does not occur when the temperature is > 26°K, but rather, that

superconductivity occurs when the temperature is -- at or below said superconducting onset

temperature --." Claim 36 has been amended to recite "less than said superconductive onset temperature."

The Examiner further states "Claim 38, lines 2 and 3, is indefinite with the language " at least one other element is an element which creates Cu ³⁺ ions" That language is unclear because no other element "creates" copper." This claim has been amended to change "create" to " result in ".

The Examiner further states "Claim 40, lines 2-4, is unclear with the language 'said superconductor being comprised of at least four elements, none of which is itself superconducting'. Included with this Office Action are pp. E-84 and E-85 of the Handbook of Chemistry and Physics (82-83), which show that rare earth and IIIB metals (La, Ce, Lu) will superconduct, as well as a IIA metal (Ba)." Claim 40 has been amended to recite "none of which is itself superconducting at a temperature in excess of 26°K."

The Examiner further states "Claim 42 is incomplete because it involves '(a) superconducting apparatus' but comprises only a composition. Means are not provided for cooling the composition and for passing an electrical current through it." Claim 42 has been amended to recite "means for passing a current".

The Examiner further states "Claim 42, line 3, is unclear because the term 'doped transition metal oxide' does not indicate what the dopant is." Applicants respectfully submit that "doped transition metal oxide" is used generically since applicants teaching

is generic, specific examples of which are given in applicants specification". See applicants' specification:

page	line
15	6-7
21	14
25	9, 19
27	13-23

The Examiner further states "Claim 43 is indefinite with the requirement that the 'doped transition metal oxide is multivalent'. A metallic element may be "multivalent" but it is unclear how an oxide may be 'multivalent' as well." This is a term used and well understood in the art. Applicants' specification at page 7, line 5, teaches multivalent metal oxides." Attachment K is a Lexis search performed by the undersigned attorney printed out using KWIC feature showing 68 issued US patents using the terminology "mixed valent metal oxide". This shows that this term is understood by a person of skill in the art and thus definite.

The Examiner further states "Claim 46 is incomplete because it involves '(a) apparatus' but comprises only a composition. Means are not provided for cooling the composition or for passing an electrical current through it is incomplete because it involves '(a) superconducting apparatus' but comprises only a composition. Means are not provided for cooling the composition or for passing an electrical current through it." Claim 46 has been amended to recite "a means for passing a current".

The Examiner further states "Claim 55, lines 3-5, are indefinite with the language 'said transition metal being non-superconducting and said oxide having multivalent states'. Presumably the transition metal is superconducting when in the appropriate oxide form. Also, the oxide itself does not have ' multivalent states', while the metallic elements may." Claim 55 has been amended to recite "said transition metal oxide being non-superconducting at said superconducting onset temperature". The terminology "oxide having multivalent states" is as indicated above understood in the art and thus definite.

The Examiner further states "Claim 55 also does not provide for a -- superconducting onset temperature in excess of 26°K --, nor does it provide for a means of cooling the composition and passing an electrical current -- at a temperature at or below said superconducting onset temperature --." Claims 55 has been amended to recite a "superconducting onset temperature".

The Examiner further states "Claim 57, lines 3 and 4, is unclear with the language 'containing at least 3 non-superconducting elements'. Those elements are not 'non-superconducting elements' when they form part of the 'superconducting oxide'." Claim 57 has been amended to state that the 3 elements are non-superconducting at the onset temperature (that is as single elements).

The Examiner further states " Claim 57, line 5, is unclear with the term 'supercurrent'." The term "supercurrent" has been changed to "superconducting current".

The Examiner further states " Claim 57 does not provide for a means of cooling the composition and passing an electrical current -- at a temperature at or below said superconducting onset temperature --." The claim has been amended to recite "and less than said superconductive onset temperature"

The Examiner further states "Claim 58, lines 2 and 3, is unclear with the language 'an element which creates a mixed valent state in said oxide'. The element itself does not 'create' that state, and that mixed valent state is found in the metals instead of the oxide itself." The term "create" has been changed to "results in".

The Examiner further states "Claim 58, line 4, is unclear with the term "layer-like structure".

The Poole et al. book states at page 20 "[a] great deal has been said about the layering characteristics of the newer oxide materials. Layered-type superconductors with transitions temperatures in the reasonably high range from 4 to 7 K have been known for some time."

From this it is clear that the term "layered-type" or "layer-like" are understood to a person of skill in the art". (See Attachment L.)

The Examiner further states " Claim 58, line 5, is unclear with the term 'supercurrent'." This term has been changed to "superconducting current".

The Examiner further states "Claim 58, lines 5-9, does not provide for a -- superconducting onset temperature in excess of 26°K --, nor does it provide for a means of cooling the composition and passing an electrical current -- at a temperature

at or below said superconducting onset temperature." Claim 59 has been amended to recite "less than said onset temperature".

The Examiner further states "Claim 59, lines 2, 6, 7, and 9, is unclear with the term 'ceramic-like'.

This is a term commonly used in the art. Attachment M is the results of a Lexis search performed by the undersigned attorney using the search criteria "ceramic" within one word of "like" and "copper" within one word of "oxide" and "rare" within one word of "earth". This search identified 23 issued US patents. These patents are listed in the attachment using the Lexis KWICK feature which list only those portions of the patents where these terms appear. The search was limited to this criteria since a search on "ceramic" within one word of "like" identified more than 1,000 issued US patents and a search on "ceramic" within one word of "like" in the same document as "copper" within one word of "oxide" identified more than 1000 US patents. It is clear that the term "ceramic like" is well understood in the art and is thus definite.

The Examiner further states " claim 59, lines 5-1 1, does not provide for a means of cooling the composition and passing an electrical current -- at a temperature at or below said superconducting onset temperature --." Claim 59 has been amended to recite "less than said onset temperature".

The Examiner further states "Claim 64 is indefinite. i. The term "mixed copper oxide" is unclear as to whether metals other than copper must be present." Attachment N is the results of a Lexis search performed by the undersigned attorney using the search criteria "Mixed w/1 copper w/1 oxide" and "supercond!" in the same patent. (w/1 means within one word). This search identified 13 issued US patents. These patents are listed in the attachment using the Lexis KWICK feature which list only those portions of the patents where these terms appear. Moreover, Attachment O is the same type search and listing limited to finding the terms "mixed w/1 copper w/1 oxide" in the claims and the term "supercond!" anywhere in the patent. The search identified 2 patents. It is thus clear that the "term mixed copper oxide" is a term well understood in the art and by a person of skill in the art and recognized by the USPTO as definite term for use in a claim.

The Examiner further states "Claim 64 is indefinite. ii. The term 'element' is unclear as to whether it involves an element other than copper and oxide." The term "element" is clear, it is a "chemical element".

The Examiner further states "Claim 64 is indefinite. iii. The language 'distorted octahedral oxygen environment' is unclear as to what the 'environment' is or how it is related to the composition." In Attachment P there is a copy of pages 75-76 of the book

by Poole et al. which states in Section 4 entitled "Atomic Arrangements" "The ionic radius of Ba²⁺ and O²⁻ (1.32 Å) are almost the same, and together they form a face-centered cubic (fcc) close-packed lattice with the smaller Ti⁴⁺ ions (0.68 Å) located in octahedral holes. The octahedral holes of a close-packed oxygen lattice have a radius of 0.545 Å, and if these holes were empty the lattice parameter would be $a=3.73$, as shown on Fig. VI-4a. If each titanium were to move the surrounding oxygens apart to its ionic radius when occupying the hole, as shown on Fig. VI-4b, the lattice parameter a would be 4.00 Å. The observed cubic ($a=4.012$ Å) and the tetragonal ($a=3.995$ Å, $c=4.034$ Å) lattice parameters are close to these values, indicating a **pushing apart** of the oxygens. The **tetragonal distortions illustrated** on Fig. VI-2 and the orthorhombic distortion of Eq. (VI-3) constitute attempts to achieve this through an enlarged but distorted octahedral site. **This same mechanism is operative in the oxide superconductors.** (Emphasis added). Thus the language "distorted octahedral oxygen environment" is a term used in the art, well understood by a person of skill in the art and thus definite.

The Examiner further states " Claim 64 is indefinite iv. That claim does not provide for a -- superconducting onset temperature in excess of 26°K --, nor does it provide for a means of cooling the composition and passing an electrical current -- at a temperature at or below said superconducting onset temperature." Claim 64 has been amended to recite "and less than said T_c ".

The Examiner further states "Claim 64 is indefinite V. The term 'supercurrent' is unclear."

This term has been changed to "superconducting current".

The examiner further states "Claim 69 does not provide for a -- superconducting onset temperature in excess of 26°K --, nor does it provide for a means of cooling the composition and passing an electrical current -- at a temperature at or below said superconducting transition temperature" Claim 69 has been amended to recite " and less than said superconducting transition temperature."

The Examiner further states " Claim 72 is unclear with the term "rare earth-like element" This term is clear for the reasons given above.

The examiner further states " Claim 77 is unclear with the terms "rare earth-like element" and "layer-like crystalline structure". These terms are clear for the reasons given above.

The Examiner further states "Claim 77 also is unclear with the recitation 'said composition having ... multi- valent oxidation states'. The metallic elements have those

states, not the composition per se." As noted above this is commonly used terminology in the art and is understood by a person of skill in the art and is thus clear.

The Examiner further states "Claim 77 further does not provide for a -- superconducting onset temperature in excess of 26°K --, nor does it provide for a means of cooling the composition and passing an electrical current -- at a temperature at or below said superconducting transition temperature." Claim 77 has been amended to recite "said mixed copper oxide having a superconducting onset temperature greater than 26°K" and to recite "and less than said onset temperature."

The Examiner further states "Claim 80 is unclear with the term "perovskite-like". As note above this is a term used in the art and understood by a person of skill in the art and is thus clear.

The Examiner further states "Claim 84 does not provide for a -- superconducting onset temperature in excess of 26°K --, nor does it provide for a means of cooling the composition and passing an electrical current -- at a temperature at or below said superconducting transition temperature." Claim 84 has been amended to recite "said transition metal oxide has a superconducting onset temperature in excess of 26°K." and to recite " and less than said superconducting onset temperature" and to recite "passing an electrical superconducting current". It is not necessary to recite a means for cooling.

The Examiner further states "Claim 86, line 2, is unclear with the term "rare earth-like" element."

As described above this term is a well know term used in the art and understood by a person of skill in the art.

The Examiner further states "Claim 86, line 3, should have -- metal -- instead of "'metla' ". This change has been made.

The Examiner further states "Claim 86 does it provide for a means of cooling the composition and passing an electrical current -- at a temperature at or below the temperature for said superconducting state --." Claim 86 has been amended to include "and less than said superconducting onset temperature".

The Examiner further states "Claim 91 is unclear with the language "exhibiting the onset of a DC substantially zero resistance state" because the term "DC" has not been defined. "DC" is a well known term used in the electrical arts (to which an electrically conducting invention part) for "direct current". Since the present invention is directed to a device, structure, apparatus or invention carrying, passing, transmitting, etc. a current it is part of the electrical arts. (See the description of applicant's Fig. 1 on page 10 of their specification and the first paragraph on page 20 and applicants' resistivity measurements in applicants' Figs. 2-4)

The Examiner further states "Claim 91 does not provide for a -- superconducting onset temperature in excess of 26°K --, nor does it provide for a means of cooling the composition and passing an electrical current -- at a temperature at or below said superconducting transition temperature." The claim recites the onset of the zero resistance state which is shown in applicants' Figs. 2-4. This is an alternate description to "superconducting onset temperature". "Means for cooling" does not have to be recited. The claim recites "means for passing current while it is in said substantially zero resistance state."

The Examiner further states " Claim 93 is indefinite. i. That claim is unclear with the term 'mixed copper oxide' because it does not indicate with what the copper oxide is 'mixed'." As noted above this term is a term well known in the art and understood by a person of skill in the art and thus not indefinite.

The Examiner further states " Claim 93 is indefinite. ii. That claim does not provide for a means of cooling the composition and passing an electrical current -- at a temperature at or below said onset temperature." The claim recites "while it is in a superconductive state". What the Examiner is suggesting is encompassed by this language.

The Examiner further states " Claim 94 is unclear with the term "layer-like". As described above this is a term well known in the art and understood by a person of skill in the art and therefore, the claim is not indefinite.

The Examiner further states " Claim 95 is unclear with the requirement that 'said copper oxide material exhibits a mixed valence state'. The copper element, not the oxide material, exhibits that 'mixed valence state'." As described above this is a term well known in the art and is understood by a person of skill in the art and therefore, is clear.

The Examiner further states "Claim 96, lines 3-5, has the language "the superconductive composition consisting essentially of a copper-oxide compound having a layer-type perovskite-like crystal structure. i. The terms "type" and "like" are unclear. ii. That language also is unclear as to whether other elements must be present as well." As described above the terms "copper-oxide compound having a layer-type perovskite-like crystal structure" are well known in the art, are understood by a person of skill in the art and are thus clear

The Examiner further states " Claim 103, lines 5 and 6, is unclear with the terms 'layer-type' 'perovskite-type', and 'rare-earth-like'. As note above these terms are well known in the art and understood by a person of skill in the art and are therefore, clear.

In view of the changes to the claims and the remarks herein the Examiner is respectfully requested to withdraw the rejection of claims 1, 12-31, 33-38, 40-46, 55-59, 64, 69-72, 77-81, 84-86, 91-96, and 103 under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 1, 12-31, 33-38, 40-46, 55-59, 64, 69-72, 77-81, 84-86, 91-96, and 103 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Asahi Shinbum, International Satellite Edition (London), November 11, 1986 (hereinafter, "the Asahi Shinbum article").

The Examiner states:

a. *The scope and contents of the prior art are determined as follows:*

i. *As discussed in paper no. 20 of the ancestral application, 07/053,307, it is not fully clear to what exact date applicants are entitled. Based on the record, nonetheless, that date would appear to be no later than around December 13, 1986, the date samples were tested in the US to show superconductivity." The Asahi Shinbum article was published on November 28, 1986.*

ii. *The reference confirms superconductivity in an oxide compound of La and Cu with Ba having a structure of the so-called perovskite structure.*

b. *The differences between the prior art and the claims at issue are ascertained as follows:*

i. *Although the reference may not teach use of the testing of zero resistance for confirming superconductivity, it prima facie must have been used because it is one of two methods used for testing for superconductivity (the other being diamagnetism). Accordingly, the burden of proof is upon the applicants to show that the instantly claimed subject matter is different from and unobvious over that taught by this reference."*

ii. *The reference may not teach specifically teach a means of cooling the composition to a temperature at or below the onset of superconductivity and the means for passing an electrical current through that composition under superconducting conditions. Nevertheless, the reference did teach testing at temperatures of up to 30°K. Since temperatures on the Earth's surface are much greater than 30°K, it would have been obvious to use a cooling means to attain that colder temperature. Moreover, the reference discusses superconductivity, which connotes the passing of electricity through an object under superconducting conditions. Passing electricity under those conditions also would*

have been obvious because the reference discusses certain applications, such as very strong magnets, NMR machines, linear motorcars, electricity transport systems, etc.

iii. The reference also may not specifically teach orthorhombic-tetragonal phase transitions, doping, mixed valence states, non-stoichiometric oxygen, layered perovskite crystalline structures, electron-phonon interactions, substituted copper oxide, Cu₃ ions, ceramic materials, enhanced polaron formation, distorted octahedral oxygen environment, or distorted orthorhombic crystalline structure. Nevertheless, the reference is deemed to teach the claimed composition; the applicant or applicants need to show that his, her, or their invention is actually different from and unexpectedly better than the prior art."

C. The level of ordinary skill in the relevant art is resolved with the finding that, based on the teachings of the Asahi Shinbum article as a whole, it would have been obvious to one of such skill because that reference teaches superconductivity in an oxide compound of La and Cu with Ba having a structure of the so-called perovskite structure.

This rejection is essentially the same as the rejection in the parent application 07/053,307 filed 05/22/87. Applicants respectfully disagree. The Asahi Sinbum article report applicants work.

The Asahi Sinbum article was published November 28, 1986. At page 6, lines 7-10 of applicants' specification applicants state "[t]he basis for our invention has been described by us in the following previously published article : J.G. Bednorz and K.A. Muller, Zeitschrift fur Physik B - Condensed Matter, 64, pp. 189-193, September 1986." The parent application of the present application was filed within one year of this article and thus within one year of the Asahi Sinbum article.

The Asahi Shinbum article reports on applicants' work and says that it has been reproduced by Professor Tanaka. It is, therefore, not a proper reference, since it is essentially applicants' work.

To find the Asahi Sinbum article a valid reference would effectively take away from applicants the one year grace period given an inventor under 35 USC 102 . Anyone could cut off the inventors one year grace period by redoing the inventors work and publishing it. This would result in the one year grace period being essentially meaningless.

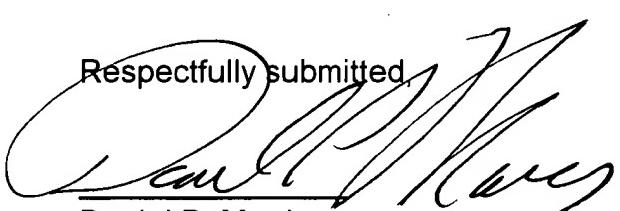
Moreover, applicants have shown by a series of affidavits in the ancestral application that they introduced the invention into the United States prior to the Asahi Sinbum article ..

In view of the changes to the claims and the remarks herein, the Examiner is respectfully requested to reconsider the above-identified application. If the Examiner wishes to discuss the application further, or if additional information would be required, the undersigned will cooperate fully to assist in the prosecution of this application.

Please charge any fee necessary to enter this paper to deposit account 09-0468.

If the above-identified Examiner's Action is a final Action, and if the above-identified application will be abandoned without further action by applicants, applicants file a Notice of Appeal to the Board of Appeals and Interferences appealing the final rejection of the claims in the above-identified Examiner's Action. Please charge deposit account 09-0468 any fee necessary to enter such Notice of Appeal.

Respectfully submitted,


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